

IRC:58-2015 Guidelines for Design of Plain Jointed Rigid Pavements for Highways			
Design of Slab Thickness for Rigid Pavement for Service Road : AMANI SHAH KA NALLA (RIDHI SIDHI)			
(with and without doweled transverse joints. Beta value will be 0.66 for doweled joint and 0.90 for without dowels case)			
Type of pavement considered		Pavement Structural Details	
Carriageway	2 Lane divided	Modulus of subgrade reaction of subgrade, MPa/m	55
		Thickness of Granular Subbase, mm	150
Shoulders :- Tied concrete shoulders ? (yes/no)	yes	Thickness of Dry Lean Concrete subbase, mm	150
Transverse joint spacing (m)	4.5	Effective modulus of subgrade reaction of foundation, MPa/m	300
Lane width (m)	2.75	Unit weight of Concrete, kN/m ³	24
Transverse Joints have dowel bars? (yes/no)	yes	28-day Flexural strength of cement concrete, MPa	4.5
Design Traffic Estimation		Max. day-time Temperature Differential in slab, °C (for bottom-up cracking)	13.1
Design Period (years)	30	Night-time Temperature Differential in slab, °C (for top-down cracking) = day-time diff/2 + 5	11.55
Total Two-way Commercial Traffic (cvpd) in the year of completion of construction	451	Trial Thickness of Concrete Slab, m	0.215
Av. Annual rate of growth of commercial traffic	0.075	Load Transfer Efficiency Factor for TDC analysis, Beta = 0.66	0.66
Cumulative No of Commercial vehicles during design period (two-way), A	17021093	Elastic Modulus of Concrete, Ec (MPa)	30000
Average No of axles per commercial vehicle, B	2.35	Poisson's Ratio of Concrete, Mu	0.15
Cumulative No of Commercial Axles during design period (two-way), C = A*B	39999568	Radius of relative stiffness, m	0.53952
Proportion of traffic in predominant direction (For 2-lane 2-way highways use a value of 1.0), D	1.00	Design Axle Load Repetitions for Fatigue Analysis	
Lateral Placement factor (0.25 for 2-lane 2-way, For multilane highways the value is 0.25 X C), E	0.250	For Bottom-up Cracking Analysis	
Factor for selection of traffic for BUC analysis (for six-hour period during day), F	0.2	Front single (steering) Axles = H * K1	499990
Factor for selection of traffic for TDC analysis (for six-hour period during day), G	0.3	Rear single Axles = H * K2	499995
Design axle repetitions for BUC analysis (for 6 hour day time traffic), H = B*E*F	1999978	Tandem Axles = H * K3	499995
Proportion of vehicles with spacing between front and the first rear axle less than the spacing of transverse joints, I	1.00	Tridem Axles = H * K4	0
Design axle repetitions for TDC analysis (for 6-hour night time traffic), J = B*E*G*I	2999968	For Top-Down Cracking Analysis	
Proportion of Front single (steering) Axles, K1	0.450	Front single (steering) Axles = J * K1	1349985
Proportion of Rear single Axles, K2	0.250	Rear single Axles = J * K2	749992
Proportion of tandem Axles, K3	0.250	Tandem Axles = J * K3	749992
Proportion of Tridem Axles, K4 = (1-K1-K2-K3)	0.000	Tridem Axles = J * K4	0



Axle Load Spectrum Data

Rear Single Axle			Rear Tandem Axle			Rear Tridem Axle		
Load Group (kN)	Mid-Point of Load Group (kN)	Frequency (%)	Load Group (kN)	Mid-Point of Load Group (kN)	Frequency (%)	Load Group (kN)	Mid-Point of Load Group (kN)	Frequency (%)
185-195	190	0.00	380 - 400	390	0.0	530-560	545	0
175-185	180	0.00	360 - 380	370	0.0	500-530	515	0
165-175	170	0.00	340 - 360	350	0.0	470-500	485	0
155-165	160	0.00	320 - 340	330	0.0	440-470	455	0
145-155	150	0.00	300 - 320	310	0.0	410-440	425	0
135-145	140	0.00	280 - 300	290	0.0	380-410	395	0
125-135	130	8.54	260 - 280	270	0.0	350-380	365	0
115-125	120	4.04	240 - 260	250	0.0	320-350	335	0
105-115	110	15.51	220 - 240	230	0.0	290-320	305	0
95-105	100	7.19	200 - 220	210	16.7	260-290	275	0
85-95	90	23.60	180 - 200	190	33.3	230-260	245	0
< 85	80	41.12	< 180	170	50.0	< 230	215	0
		100.00			100.00			0.00

Front Single Axles and Rear Tridem axles not considered for bottom-up analysis



Fatigue Damage Analysis											
Bottom-up Cracking Fatigue Analysis for Day-time (6 hour) traffic and Positive Temperature Differential											
Fatigue Damage Analysis											
Top-Down Cracking Fatigue Analysis for Night-time (6 hour) traffic and Negative Temperature Differential											
Fatigue Damage Analysis											
Near Single Axles											
Expected Repetitions (1st)	Free Stress MPa	Stress Ratio (SR)	Allowable Repetitions (1st)	Fatigue Damage (1st)	Expected Repetitions (1st)	Free Stress MPa	Stress Ratio (SR)	Allowable Repetitions (1st)	Fatigue Damage (1st)	Expected Repetitions (1st)	Fatigue Damage (1st)
0	3.371	0.481	3254	0.000	0	2.9103	0.588	43245.3136	0.000	0	0.000
0	3.254	0.453	7027	0.000	0	2.7608	0.563	80548.7058	0.000	0	0.000
0	3.007	0.424	15174	0.000	0	2.6033	0.538	174816.66	0.000	0	0.000
0	2.660	0.598	42767	0.000	0	2.5368	0.513	426845.822	0.000	0	0.000
0	2.823	0.579	30157	0.000	0	2.6180	0.488	1432193.15	0.000	0	0.000
0	2.686	0.543	154229	0.000	0	2.2928	0.463	10003035.7	0.000	0	0.000
42898	2.549	0.515	397513	0.007	0	2.1605	0.438	161646	0.000	42898	0.000
20225	2.412	0.487	1513806	0.013	0	2.0659	0.413	161646	0.000	20225	0.000
77527	2.275	0.460	55296662	0.025	0	1.9234	0.388	161646	0.000	77527	0.000
35953	2.138	0.432	161646	0.000	60332	1.7989	0.363	161646	0.000	35953	0.000
117970	2.001	0.404	161646	0.000	186885	1.6754	0.338	161646	0.000	117970	0.000
305610	1.865	0.376	161646	0.000	248997	1.5519	0.314	161646	0.000	305610	0.000
40996	Fatigue from Sing. Axles =	0.176	Fatigue from Tandem Axles =	0.176	40996	Fatigue from Tandem Axles =	0.176	Fatigue from Tandem Axles =	0.176	40996	0.000
Total Bottom-up Fatigue Damage due to single and tandem axle loads =				0.126	Total Top-Down Fatigue Damage =				0.000	Fatigue from Tandem Axles =	
				0.126					0.000		
Sum of CFD for BUC & TDC= 0.146											
DESIGN IS SAFE SINCE SUM OF CFD FOR BUC AND TDC< OR EQ 1											

